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Original Paper

Study on Oil Price Change, Internal Regulation and Profitability Index -- Taking Oil Exploitation Industry of China as an Example

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Abstract

The objective of this paper is to study the relationship between the change of oil price and the profitability of Chinese oil mining enterprises. This paper collects the relevant data of China's oil exploitation industry and listed companies from 2011 to 2020, and makes an empirical study by using the standard value weight method and regression analysis method. The conclusions are as follows: (1) from 2011 to 2020, the average annual decline of international oil price is 6.71%, which significantly weakened the profitability of Listed Companies in China's oil exploitation industry. (2) From 2011 to 2020, the average annual decline of gasoline prices in China is 2.61%. However, due to the implementation of the "minimum price" policy by the Chinese government, the profitability of Listed Companies in the oil exploitation industry has not decreased, but increased. (3) From 2011 to 2020, the internal control level of Listed Companies in China's oil exploitation industry continued to decline, which was significantly negatively correlated with profitability. (4) Listed companies in China's petroleum exploration industry adhere to the concept of sustainable development, pay attention to scientific and technological investment, effectively operate assets, increase cash flow and control costs. These measures have significantly improved the profitability of enterprises.

Keywords

oil price, Internal regulation, Profitability index, Listed companies in oil exploitation industry

1. Introduction

As an important energy product in the world, crude oil has many attributes: general commodity attribute, financial attribute and political attribute. The price fluctuation of energy products has a significant impact on the world economy, financial markets and regional stability. According to the

world energy statistics yearbook 2020 released by BP, in 2019, oil still ranked first in global fossil energy consumption, accounting for 33.1%. At the same time, China's economy has continued to grow steadily in the past few decades, the process of industrialization has been accelerating, and the demand for crude oil has also been rising. According to BP statistics, since 2015, China's annual oil consumption has continuously ranked first in the world. Due to the shortage of domestic crude oil, China's dependence on foreign crude oil has increased year by year, reaching 73.5% by 2020. In recent years, mankind has made great breakthroughs in the field of energy, and the newly discovered nuclear energy, hydrogen energy, solar energy and other energy have begun to be large-scale, industrialized and applied to our production and life. Nevertheless, oil is still an indispensable fossil energy to promote social and economic development. Of course, because of its uneven distribution and non renewable, oil has strategic attributes that other ordinary commodities do not have. Since the 21st century, international crude oil prices have fluctuated sharply. For example, the price of Brent crude oil rose to $146 / barrel when it was the highest in 2008, while the lowest value of oil price fell to $36.61 / barrel in the same year. From 2010 to 2014, the international oil price fluctuated between us $70-120 / barrel, and then fell all the way to US $26.22/barrel at the beginning of 2016. Since 2020, affected by public health emergencies and the breakdown of production reduction agreements, the price of Brent crude oil fell to US $19.33/barrel on April 21, 2020, the lowest since 2002.

In the context of international oil price fluctuations, whether internal regulation will bring positive or negative effects to enterprises, how to improve the profitability of China's oil exploitation industry, how much it has to do with international oil price fluctuations, and how to improve the profitability of enterprises is a very important issue. This paper collects the relevant data of internal regulation and profitability of China's oil exploitation industry from 2011 to 2020, and makes an empirical analysis by setting up a model, so as to reveal deep-seated problems, summarize effective experience and seek a new way for the transformation and development of oil and gas exploitation industry.

2. Research Status of International Oil Price and Internal Regulation

2.1 Research Status of International Oil Price

Searching the contents of relevant journals with "international oil price" as the "title" on CNKI (China HowNet), the research results are as follows: Zhang Yuejun et al. (2021) believe that China's excessive dependence on imports for crude oil demand has created a huge demand for foreign exchange funds. At the same time, the frequent and violent fluctuation of international oil price has caused great uncertainty to China's crude oil import cost and the economic benefits of domestic related industries. Although the listing of China's crude oil futures on March 26, 2018 can help enterprises reduce the risk of international oil price fluctuation through futures trading, if there is a major emergency in the international crude oil market, the oil enterprises will still suffer heavy losses. Xu Hongfeng et al. (2021) believe that the adjustment and change of international oil price has a certain historical law. Analyzing the historical law of oil price in the past century can better judge the current and future

change trend of international oil price, and pointed out that the war of major crude oil producing countries leads to extremely high oil price, and the economic recession and increase of crude oil supply lead to extremely low oil price. Liu Xiujuan et al. (2021) believe that the rise of international crude oil prices first directly affects the change of foreign energy prices. Energy prices lead to the increase of industrial costs of crude oil as raw materials through the price transmission mechanism, so as to improve the overall international price level. The rise of the overall international price level will increase the price of agricultural products in the primary industry, and the rise of international grain prices will lead to the increase of CPI. The novel coronavirus pneumonia (Feng Baoguo, 2017) believes that the future international oil price fluctuation depends on four factors: first, we should focus on the new crown pneumonia vaccine, the second is the Vienna alliance's reduction in production, third the US energy policy changes, and fourth the international geopolitical relationship.

2.2 Research Status of Internal Regulation of China's Oil Exploitation Industry

The research on internal control in China's oil exploitation industry has both characteristics and common characteristics. (1) From the perspective of industry characteristics, its focus is on its relationship with profitability. Li Yue (2016) believes that with the continuous improvement of enterprise product output, there will be overcapacity in the market, and it is not surprising that listed companies have the risk of financial shortage and economic downturn. At this time, strengthen internal control, optimize accounting management, realize accounting earnings supervision through the analysis of accounting endogenous business risks of listed companies, and achieve the purpose of controlling business risks through the evaluation of business rules. Zhang Chengdong (2010) believes that the enterprise development strategy should be consistent with the national macro-control policy, find a combination point in internal control, and don't give up. Foreign investors also attach great importance to developing the Chinese market. They can cooperate with the Chinese Association of chief accountants, seek new cooperation opportunities in China, promote the integrated development of the world economy, and comprehensively improve the level of macro-control and internal control of enterprises. Zhang Yingying (2010) believes that enterprise internal regulation is a very important part of enterprise property management and cost management, which is of various significance to enterprise financial decision-making. However, from the actual situation of China's current enterprise operation, a few enterprise property management staff are not aware of the connection between them, and divisional management and control restricts the quality and efficiency of financial work. The effective combination of internal regulation and property accounting to improve the quality of both is an important development trend of the company's property management in the future. (2) From the perspective of common factors affecting the quality of internal control, Yan Yutong (2021) verified the positive impact of the financial background of board members on the quality of internal control through 4993 sets of annual data of 1798 listed enterprises in China from 2013 to 2017. After controlling the enterprise characteristics such as enterprise scale, leverage ratio and operating income, as well as the impact of the size of the board of directors, the proportion of independent directors, the age of directors

and educational background, this impact is still significant. By distinguishing different types of financial background of directors, it is found that compared with directors with banking background, directors with experience in securities, trust and other non bank financial institutions have a more comprehensive understanding of the operation of the financial industry, a more accurate understanding of risks and benefits, and can more effectively supervise and guide the investment and financing behavior of enterprise management, Then it can better improve the quality of enterprise internal control. Zou Meifeng et al. (2021) believe that the enterprise's risk bearing capacity is an ability for enterprises to balance the relationship between high-yield and high-risk, which has a direct impact on the enterprise's innovation investment and future development potential. Using the data of Shanghai and Shenzhen A-share non-financial listed companies from 2007 to 2018, this paper shows that the uncertainty of economic policy leads to risks. The research shows that the uncertainty of economic policy reduces the ability of enterprises to bear risks, which is more significant in non-state-owned enterprises, low growth enterprises and small-scale enterprises; Internal control can regulate the relationship between them. This shows that the government needs to maintain a certain degree of continuity and accuracy when formulating corresponding policies. In order to improve the anti risk ability, enterprises will also pay attention to the construction of internal control system. Xu Yude et al. (2021) believe that management overconfidence will lead to overestimation of the accuracy of their decisions and underestimate the risk of failure, which will have a negative impact on the effectiveness of internal control. Formal and informal systems can effectively restrain cognitive biases such as management overconfidence. He conducted an empirical test with the data of A-share listed companies in Shanghai and Shenzhen, and concluded that management overconfidence had a significant impact on the effectiveness of internal control under different formal and informal institutional environments. It is found that there is a significant negative correlation between Managerial Overconfidence and the effectiveness of internal control. Good formal and informal systems have a positive regulatory effect on Managerial Overconfidence and the effectiveness of internal control; Management overconfidence in state-owned enterprises has a more significant negative impact on the effectiveness of internal control. Under the informal institutional environment, management overconfidence in private enterprises does not have a significant regulatory effect on the effectiveness of internal control. This research conclusion provides empirical evidence for improving the effectiveness of internal control by coordinating formal system and regulating informal system. Dong Xiaohong et al. (2021) believe that there is a significant negative correlation between enterprise financialization tendency and audit quality, but internal control can significantly inhibit the negative impact of enterprise financialization tendency on audit quality; Audit business complexity and audit risk play a significant intermediary effect in the impact of enterprise financialization on audit quality, that is, enterprise financialization reduces audit quality by increasing business complexity and audit risk; However, the use of internal control can deal with the risks brought by enterprise financialization; Among the five elements of internal control, internal supervision can significantly inhibit the negative impact of enterprise financialization on audit quality,

while internal environment, risk assessment, information communication and control activities can not significantly inhibit the negative impact of enterprise financialization on audit quality. The research conclusion enriches the relevant literature in the field of enterprise financialization and audit quality, develops the economic consequence theory of enterprise financialization, and provides empirical evidence for the construction and implementation of enterprise internal control system.

2.3 Review of Research Status

The above research highlights the strategic impact of changes in international oil prices on world energy development, the impact on national economies and the impact on national politics, the impact of internal control on enterprise profitability, and the research on the influencing factors of internal control quality, which is of great significance for people to grasp the trend of economic development and improve the initiative and consciousness of internal control, However, it is necessary to further study the impact of changes in international and domestic oil prices on the strengthening of internal control and the profitability of China's oil mining enterprises. This paper will explore these two aspects.

3. Research Design

3.1 Logical Relationship Analysis of Research Content and Research Framework Design

There are many factors affecting the "profitability" of China's "oil exploitation" enterprises. The most prominent factors are: (1) oil price is the basic premise to determine the profitability of oil and gas exploitation enterprises. Taking crude oil as an example, Chinese petroleum exploration enterprises sell the crude oil extracted from oil wells to "refining enterprises", which then process the crude oil into finished oil (including gasoline, kerosene, diesel, fuel oil, etc.), or sell the crude oil to "chemical enterprises", which then process the crude oil into chemical light oil (including naphtha, fuel oil, liquefaction station, lubricating oil, etc.) Heavy oil (including coke, residue, paraffin, asphalt, etc.). The oil price level of China's oil exploitation enterprises directly reflects the "operating income" of enterprises, and the operating income is the beginning of enterprise profitability. One of the important factors determining the oil price of Chinese oil exploitation enterprises is the international and domestic oil price level. This paper discusses the impact of changes in international and domestic oil prices on the profitability of oil mining enterprises in China. (2) The key factor affecting the profitability of enterprises is the level of internal control. Because in the process of production and operation, enterprises should control the investment of funds, control various material consumption, control various costs, and exchange the smallest (least) input for the largest (most) output. If the enterprise's internal control is done well, the enterprise can achieve the profit target and improve the profitability according to the predetermined plan. (3) The direct factor for enterprises to create profitability. From the perspective of accounting elements, these elements are asset distribution, liability level, production consumption, cash flow, technical transformation level, employee contribution value, etc. without these production factors to play a role, the enterprise can not talk about profitability. Therefore, the research mechanism, logical path and research framework of this paper are shown in Figure 1:

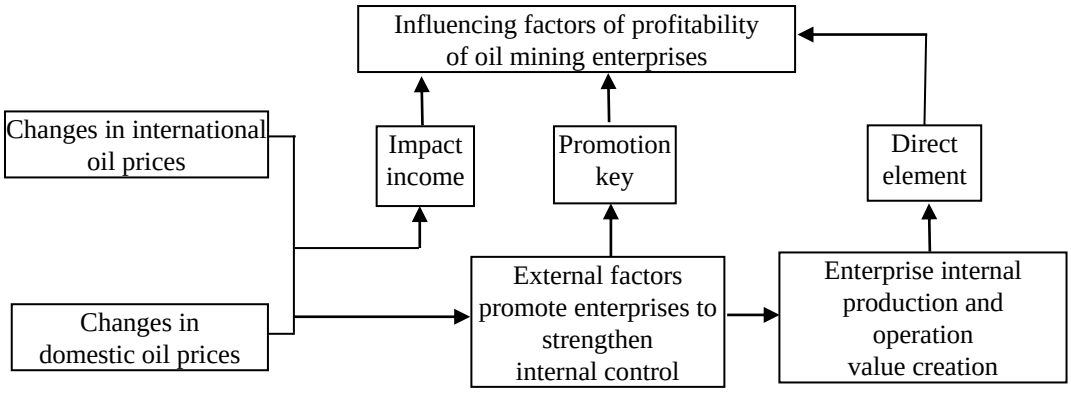

Figure 1. Research Mechanism, Logical Path and Research Framework of the Paper

3.2 Setting and Calculation of Profitability Index of Oil and Gas Exploitation Enterprises

There are six indicators for evaluating the "profitability" of enterprises determined by the assessment and Distribution Bureau of SASAC of the State Council (formerly known as the "financial supervision, assessment and Evaluation Bureau of SASAC of the State Council"): return on net assets; Return on total assets; Sales (operating) profit margin; Surplus cash cover; Cost profit margin; Return on capital. One of the methods to convert these six profitability indicators into "profitability index" is the "standard value weight method", and the calculation formula is as follows:

$$Profitability\ index = \sum_{n=1}^{6} \left(\begin{matrix} Profitability\ index \\ of\ an\ enterprise \end{matrix} \div \begin{matrix} Standard\ value\ of \\ profitability\ of\ the\ industry \end{matrix} \times Weights \right)$$

The "standard value" of industry profitability in the above formula shall be published by the assessment and Distribution Bureau of SASAC of the State Council in the assessment year. In the standard value of enterprise performance evaluation published by him, "average value" is used in the formula. The "weight" in the formula is also determined by the Interim Measures for the administration of comprehensive performance evaluation of central enterprises issued by SASAC. See Table 1 for details, but the total weight score of 68 points of the six indicators shall be converted into 100 points. The conversion formula is as follows:

$$\begin{matrix} Weight\ conversion\ score \\ of\ a\ profitability\ index \end{matrix} = \frac{100}{68} \times \begin{matrix} The\ profitability\ index \\ has\ a\ weight\ score \end{matrix}$$

The value of "100 ÷68" in the above formula is 1.4706. The conversion scores of the six indicators are shown in Table 1. In order to illustrate the application of the above formula, taking the profitability index of "PetroChina" listed company in 2020 as an example, the calculation process of profitability index is shown in Table 1:

Table 1. Calculation of Profitability Index of "PetroChina" Listed Companies in 2020

Index	Converted weight score	Profitability index value of Petro China in 2020	Standard value of profitability of oil and gas exploitation industry in 2020	PetroChina's profitability index in 2020
	1	2	3	4=2/3×1
Rate of return on equity	29	0.0155	0.0190	23.6579
Return on total assets	21	0.0305	0.0150	42.7000
Profit rate of business revenue	15	0.0335	0.0270	18.6111
Ratio of net operating cash flow to net profit	13	9.5151	1.7000	72.7625
Ratio of Profits to Cost	12	0.0330	0.0160	24.7500
Return on capital	10	0.0260	0.0390	6.6667
Total	100			189.1482

Note. The calculation method of "profitability index" of Listed Companies in China's oil and gas exploration industry in each year is analogized in the above table.

It can be seen from Table 1 that the profitability index of "PetroChina" listed companies in 2020 is 189.1482 points, 1.89 times of 100 points in the national assessment standard, with strong profitability.

3.3 Collection and Evaluation of International and Domestic Oil Price Change Data

(1) Collection of data on changes in international oil prices. Internationally, there are three authoritative institutions to reflect the changes in international crude oil prices: first, the price of "Brent crude oil" is published by the London Intercontinental Exchange every day; Second, the price of "WTI crude oil" is announced by the New York Mercantile Exchange every day; The third is the price of "Dubai crude oil", which is announced by the Ministry of energy of the United Arab Emirates. Taking the price of "WTI crude oil" as an example, the international crude oil price from 2010 to 2020 is shown in Table 2:

Table 2. Price List of WTI Crude Oil in New York from 2010 to 2020

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average price (USD / barrel)	$79.48	$94.88	$94.05	$97.98	$93.17	$48.72	$43.58	$50.84	$64.90	$56.99	$39.68
Crude oil price change rate (%)		119.38%	99.13%	104.18%	95.09%	52.29%	89.45%	116.66%	127.66%	87.81%	69.63%

Data source: New York Mercantile Exchange. Historical price of WTI crude oil in New York, USA[EB/OL]. http://info.usd-cny.com/wti/lishi.htm.[2021-04-09].

It can be seen from table 2 that the WTI crude oil price in New York continued to decline from US $79.48 per barrel in 2010 to US $39.68 per barrel in 2020, with an average annual decline of 6.71%.

(2) Collection of domestic oil price change data. The Chinese government has formulated the policy of linking and floating domestic oil prices with international oil prices. However, in order to prevent the excessive decline of oil prices from causing significant adverse effects on the economic benefits of China's petrochemical enterprises, the national development and Reform Commission issued the measures for the administration of oil prices on January 13, 2016, setting the "floor price" (minimum guaranteed price) and establishing the "risk reserve for oil price regulation" to ensure that the oil price operates within a reasonable range. In China, chemical products network - gasoline network (http://www.chemcp.com/news/Price/Qiyou/) keeps announcing refined oil prices of refineries. See Table 3 for China's 93#, 95# gasoline prices from 2010 to 2020:

Table 3. Price List of Chinese 93#, 95# Gasoline from 2010 to 2020 unit: yuan / ton

year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
93#gasoline quotation	8460[b]	9309[a]	8667	8453	5980	5200	5930	6400	6900	6850	6100
95#gasoline quotation											
price change rate		110.00%	93.10%	97.53%	75.37%	86.96%	114.04%	107.93%	107.81%	99.28%	89.05%

Note. a. is the simple average price of 93# gasoline in 38 cities on December 30, 2011:
http://www.chemcp.com/news/201112/252457.asp;
b. Simple average price of 93# gasoline in 24 cities on December 30, 2010:
http://www.chemcp.com/news/201012/165423.asp
Other oil price networks (omitted)

3.4 Setting and Evaluation of Internal Control Indicators of Listed Companies in China's Oil Exploitation Industry

According to the regulations of China Securities Regulatory Commission, China's listed companies should disclose the company's internal control to the public every year. Shenzhen Dibo Enterprise Risk Management Technology Co., Ltd. has established a "DIB database", in which sub databases such as "internal control index" of Chinese listed companies are constructed to objectively evaluate the internal control level of Chinese listed companies. This database has been widely used by management institutions, research institutions, experts and scholars of Listed Companies (Chi Guohua, 2011). The author consulted the "internal control index" of all listed companies (7 in total) in the oil exploitation industry from 2011 to 2020 in the DIB database. In order to match the data of the later model, the "internal control index" of each listed company was divided by 1000 to obtain an internal control index less than 1 for the later model, This paper discusses the relationship between internal control variables and profitability of Listed Companies in China's oil exploitation industry from 2011 to 2020.

In order to evaluate the internal control level of Listed Companies in China's oil exploitation industry, the author summarizes the annual "internal control index" of Listed Companies in China's oil and gas industry from 2011 to 2020, and calculates the annual average value (reduced by 1000 times), as shown in Table 4:

Table 4. Annual "Internal Control Index" of Listed Companies in China's Oil and Gas Industry from 2011 to 2020

year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Annual increasing rate (%)
Internal control index	0.7013	0.6729	0.6503	0.6205	0.6377	0.6507	0.6608	0.6617	0.6375	0.5561	-2.64%

Data source: According to dibdata (http://www.dibdata.CN); The annual data is the average value of the "internal control index" of Listed Companies in the oil exploitation industry

As can be seen from the data in Table 4, the internal control index of the oil exploitation industry showed a downward trend from 2011 to 2020, with an average annual increase and decrease of 2.64%.

3.5 Model Setting

3.5.1 Setting of Explained Variables

The explanatory variable of the model is "profitability index", which is reflected by fit. It is a comprehensive indicator of the profitability of Listed Companies in China's oil exploitation industry. It is composed of six indicators: return on net assets, return on total assets, operating profit margin, surplus cash guarantee multiple, cost profit margin and return on capital.

3.5.2 Setting of Explanatory Variables

First, it is reflected by the "international oil price change rate"; Second, it is reflected by "domestic oil price change rate"; Third, it is reflected by the internal control index (intcontr).

3.5.3 Setting of Control Variables

The setting of control indicators includes: (1) sustainable growth rate (susgrowth). It is the highest growth rate that the listed company can achieve the sales target in that year. Its premise is not to issue new shares, and maintain the current operating efficiency and financial policy stability. The quantitative formula of "operating efficiency" is: net profit margin on sales × Asset turnover product; Financial policy stability includes the stability of dividend payment rate and the relative stability of capital structure. (2) Asset liability ratio (Lev). It is the ratio of total liabilities to total assets. (3) Fixed assets turnover rate (fixasstur). It is the ratio of sales revenue to net value of fixed assets. It not only reflects the turnover amount (sales revenue) brought by the use of fixed assets within a year, but also reflects the turnover speed of fixed assets. (4) Quick ratio. It is the ratio of quick assets to current liabilities after deducting inventory from current assets. (5) Technical input ratio (techratio). It is the ratio of the

enterprise's science and technology investment (expenditure) to the total operating income of the current year. (6) Cash recovery rate of total assets (cashasset). It is the ratio of net operating cash flow to total average assets of the enterprise in the current year. (7) Cost ratio. It is the ratio of period expenses to total operating costs.

3.5.4 Model Construction

According to the above analysis, the profitability index model of China's oil exploitation industry is constructed as follows:

$$PROFIT=\alpha_0 + \alpha_1 InterPrice + \alpha_2 DomePrice + \alpha_3 IntContr + \alpha_4 SusGrowth + \alpha_5 LEV + \alpha_6 FixassTur + \alpha_7 QuickRatio + \alpha_8 TechRatio + \alpha_9 CashAsset + \alpha_{10} CostRatio \quad (\text{Model1})$$

3.5.5 Definition of Model Variables

The definition of model variables determined according to model 1 set above is shown in Table 5:

Table 5. Definition of Model Variables

Variable name		Symbol	Variable definition
Explained variable	Profitability index	*PROFIT*	Profitability index calculated by "standard value weight method", Table 1 provides examples
Explanatory variable	Change rate of international oil price	*InterPrice*	Table 2 "crude oil price change rate" is allocated to each listed company according to annual data
	Change rate of domestic oil price	*DomePrice*	In Table 3, China's 93# and 95# gasoline prices are allocated to listed companies according to annual data
	Internal control index	*IntContr*	"Internal control index" of each company in DIB database ÷1000
	Sustainable growth rate	*SusGrowth*	$\frac{\text{Net profit margin on sales} \times \text{Total asset turnover} \times \text{Profit retention rate} \times \text{Equity multiplier}}{\left(1 - \text{Net profit margin on sales} \times \text{Total asset turnover} \times \text{Profit retention rate} \times \text{Equity multiplier}\right)}$
control variable	Leverage Ratio	*LEV*	$\text{Total liabilities at the end of the period} \div \text{Total assets at the end of the period}$
	Turnover rate of fixed assets	*FixassTur*	$\text{Current } operating\ income \div \text{Average balance of net fixed assets at the end of the period}$
	Quick ratio	*QuickRatio*	$\left(\text{Current assets at the end of the period} - Inventory\ at\ the\ end\ of\ the\ current\ period\right)$ ÷Current liabilities at the end of the period
	Technology input ratio	*TechRatio*	$\text{Total science and technology } expenditure\ of\ the\ current\ year \div \text{Total operating income } of\ the\ current\ period$

Cash recovery rate of total assets	*CashAsset*	Current net operating $cash\ flow$ ÷ Average total assets $of\ the\ current\ period$
Change rate of cost	*CostexRato*	$Current\ period\ expenses$ ÷ Total operating cost $of\ the\ current\ period$

4. Model Application

4.1 Sample Selection and Data Source

In Table 5, the data of six indicators of Listed Companies in the oil exploitation industry related to the explained variable (profitability index) are from the income statement, balance sheet and cash flow statement of seven listed companies in the oil exploitation industry on the website of "zhongcai.com" from 2011 to 2020, and the annual standard values of the six indicators are from the annual standard values of enterprise performance evaluation (compiled and published by the assessment and Distribution Bureau of SASAC of the State Council); the explanatory variable - oil price change data in Table 5 is from Table 2 and Table 3, and the internal control index is from DIB database; the control variable data in Table 5 is from the income statement, balance sheet and cash flow statement of 7 listed companies in the oil exploitation industry on the website of "zhongcai.com" from 2011 to 2020.

4.2 Descriptive Statistics

According to the designed model and the collected sample data, descriptive statistics are carried out by spss25.0. The statistical results are shown in Table 6:

Table 6. Descriptive Statistics of Model 1 Variables

	N	minimum value	maximum value	mean value	standard deviation
Profitability index	70	25.2582	740.0650	210.1787	163.8796
Change rate of international oil price	70	0.5229	1.2766	0.9613	0.2200
Change rate of domestic oil price	70	0.7537	1.1404	0.9811	0.1164
Internal control index	70	0.2266	0.9954	0.6450	0.1238
Sustainable growth rate	70	-0.0186	0.3479	0.0716	0.0821
Leverage Ratio	70	0.0456	0.9411	0.5249	0.1505
Turnover rate of fixed assets	70	0.1900	101.1800	8.5776	19.7320
Quick ratio	70	0.1200	5.0700	0.7084	0.7402
Technology input ratio	70	0.0110	0.0130	0.0121	0.0008
Cash recovery rate of total assets	70	-0.1155	0.1791	0.0632	0.0569
Change rate of cost	70	0.0956	2.2050	0.4161	0.3878
effective N (listwise)	70				

According to the descriptive statistics in Table 6, the average profitability index of 7 listed companies in China's oil exploitation industry from 2011 to 2020 was 210.1787; The average change rate of international oil price is 0.9613; The average change rate of domestic oil price is 0.9811; The average internal control index is 0.6450; The average sustainable growth rate is 0.0716; The average asset liability ratio is 0.5249; The average turnover rate of fixed assets is 8.5776; The average quick ratio is 0.7084; The average technology input ratio is 0.0121; The average cash recovery rate of total assets is 0.0632, and the average change rate of cost is 0.4161. All variable values are in the normal4.3 regression analysis.

4.3 Regression Analysis

The regression results of the influencing factors model 1 of the profitability of 7 listed companies in China's oil exploitation industry from 2011 to 2020 are shown in Table 7:

Table 7. Regression Analysis Results of Influencing Factors (Model 1) of "Profitability" of Listed Companies in China's Oil Exploitation Industry from 2011 to 2020

variable	Model (1) explained variable: profitability index
Constant	-1131.2051***
	(-3.8158)
Change rate of international oil price	-193.9627***
	(-2.6867)
Change rate of domestic oil price	563.0407***
	(4.0778)
Internal control index	-414.4831***
	(-2.9117)
Sustainable growth rate	890.9258***
	(5.3184)
Leverage Ratio	-78.0326
	(-0.6313)
Turnover rate of fixed assets	0.4405
	(0.6556)
Quick ratio	-45.2846*
	(-1.9302)
Technology input ratio	102776.2873***
	(5.7422)
Cash recovery rate of total assets	577.4232*
	(1.8260)
Change rate of cost	-76.4747**
	(-2.1251)

Year	Dummy variable
R^2	0.6677
Adj R^2	0.6113
F	11.8525***
N	69

Note. the values in brackets in the table are t coefficients of regression analysis; *, * **** The significant levels are 10%, 5% and 1%, respectively

It can be seen from the results of regression analysis in Table 7 that the significance test of all independent variables (10 in total) of model 1 on the explained variables (profitability index) passed 8, and the significance coefficient of asset liability ratio was 0.5303 and the significance coefficient of fixed asset turnover was 0.5146, which were greater than 0.1, so they failed to pass the significance test. The adjusted R-square (adj R2) of 0.6113 is greater than the judgment coefficient of 0.5, indicating that the fitting between the set model 1 variables is good. The specific analysis is as follows:

(1) The international oil price change rate (interprice) is significantly negatively correlated with the profitability index (profit) at the level of 1%. This shows that the smaller the change rate (growth rate) of international oil price, the better the profitability of Listed Companies in China's oil exploitation industry.

(2) There is a significant positive correlation between domestic oil price change rate (domeprice) and profitability index (profit) at the level of 1%. This shows that the growth of domestic oil price will promote the profitability of Listed Companies in China's oil exploitation industry. The greater the change rate (growth rate) of domestic oil price, the better the profitability of Listed Companies in China's oil exploitation industry.

(3) There is a significant negative correlation between internal control index (intcontr) and profitability index (profit) at the level of 1%. This shows that the internal control of Listed Companies in China's oil exploitation industry does not match the growth of their profitability. In fact, after summarizing the internal control indexes of Listed Companies in Table 4, it can be seen that the internal control index of Listed Companies in China's oil exploitation industry decreased year by year from 2011 to 2020, from 0.7013 in 2011 to 0.5561 in 2020, with an average annual decrease of 2.64%. In this case, the greater the decline rate of internal control index, the worse the profitability of the enterprise.

(4) Analysis of control variables and profitability index (profit): (a) sustainable growth rate (susgrowth), technology input ratio (techratio), cash recovery rate of total assets (cashasset) and profitability index (profit) are significantly positively correlated at the level of 1% and 10% respectively. This shows that the stronger the sustainable development ability of all listed companies in China's oil exploitation industry, the greater the investment in science and technology, and the more cash flow recovered by using total assets, the better the profitability of enterprises. (b) Quick ratio, costex ratio and profitability index (profit) are significantly negatively correlated at the levels of 10% and 5% respectively. The

former shows that the change of quick ratio of Listed Companies in China's oil exploitation industry can not positively promote the enhancement of enterprise profitability. In fact, by summarizing the quick ratio of Listed Companies in China's oil exploitation industry from 2011 to 2020, it is found that the annual summary ratio continues to decline, from 0.9014 in 2011 to 0.5657 in 2020, with an average annual decline of 5.04%. The main reason for the decline is that the growth rate of current liabilities, the denominator of quick ratio, far exceeds the growth rate of numerator quick assets. Therefore, The faster the growth rate of the total current liabilities of enterprises, the worse the short-term solvency of enterprises, and the greater the adverse impact on the profitability of enterprises; The latter shows that the greater the change rate of cost and expense of Listed Companies in China's oil exploitation industry, the more the enterprise period expenses, the less the enterprise profit, and the worse the profitability.

(c) Asset liability ratio (Lev) is negatively correlated with corporate profitability (FIT), but not significantly; Fixed asset turnover (fixasstur) is positively correlated with profitability index (profit), but not significant. The former shows that the increase of debt of Listed Companies in China's oil exploitation industry will affect the continuous improvement of enterprise profitability; The latter shows that the listed companies in China's oil exploration industry accelerate the transfer of fixed assets to the improvement of enterprise profitability, but they do not significantly determine the growth of enterprise profitability.

5. Robustness Test

In order to test the reliability of the research conclusion of the model and avoid the occurrence of endogenous between variables, the robustness test of model 1 should be carried out. Since the explanatory variable "profitability index" of model 1 is a comprehensive variable composed of six variables, the mean value after three-year moving adjustment can be used to replace the explanatory variable in the robustness test, that is, model 1 selects "mean value of profitability index" to replace the explanatory variable "profitability index", and the other explanatory variables and control variables remain unchanged. After regression analysis, See Table 8 for the following results:

Table 8. Robustness Test Results of Model 1 of China's Oil and Gas Exploration Listed Companies from 2011 to 2020

variable	Model (1) explained variable: mean value of profitability index
Constant	-1048.5545***
	(-6.3993)
Change rate of international oil price	-78.4806*
	(-1.9668)
Change rate of domestic oil price	436.5296***
	(5.7200)

Internal control index	-104.7671
	(-1.3315)
Sustainable growth rate	313.0461***
	(3.3810)
Leverage Ratio	-139.7816**
	(-2.0460)
Turnover rate of fixed assets	-0.2389
	(-0.6432)
Quick ratio	-24.1872*
	(-1.8648)
Technology input ratio	84436.4492***
	(8.5352)
Cash recovery rate of total assets	-72.3289
	(-0.4138)
Change rate of cost	44.3698**
	(2.2307)
Year	Dummy variable
R^2	0.7701
Adj R^2	0.7311
F	19.7581***
N	69

Note. the values in brackets in the table are t coefficients of regression analysis; *, * **** The significant levels are 10%, 5% and 1%, respectively

It can be seen from the robustness test in Table 8 that model 1 uses “mean value of profitability index” instead of “profitability index” for regression analysis, and the nature of positive correlation of 4 independent variables and negative correlation of 5 independent variables has not changed much before replacement (only one difference); The significance of 10 independent variables passed 7, and 8 variables passed the significance test before replacement, with a difference of only 1. That is to say, the regression result of model 1 is more robust and reliable.

6. Intermediary Variable Test

Model 1 sets three explanatory variables: “international oil price change rate”, “domestic oil price change rate” and “internal control index”. Among them, whether the “internal control index” is an “intermediary variable” needs to be tested: (1) if the “internal control index” is taken as the dependent variable and the “international oil price change rate” and “domestic oil price change rate” are taken as

the independent variables, the two are significantly correlated, which shows that the changes of international and domestic oil prices urge the listed companies in China's oil exploitation industry to strengthen internal management and control, The "internal control index" is an intermediary variable, otherwise the "internal control index" is not an intermediary variable. (2) excluding the factors of oil price changes, the "internal control index", control variables and enterprise profitability index are regressed, and the correlation changes of the "internal control index" are observed, so as to determine the influence of its intermediary variables. Through (1) (2) The inspection results of the two methods are shown in Table 9:

Table 9. Test Results of Intermediary Variables of Model 1 of Listed Companies in Oil Exploitation Industry from 2011 to 2020

variable	Explained variable: internal control index (test 1)	Explained variable: profitability index (test 2)
Constant	0.4760***	-827.7823***
	(3.7830)	(-2.5952)
Change rate of international oil price	0.0766	
	(0.9643)	
Change rate of domestic oil price	0.0971	
	(0.5278)	
Internal control index		-419.4930***
		(-2.6993)
Sustainable growth rate		803.1131***
		(4.42667)
Leverage Ratio		-51.3398
		(-0.3791)
Turnover rate of fixed assets		0.1513
		(0.20386)
Quick ratio		-20.4589
		(-0.8172)
Technology input ratio		104433.1274***
		(5.2344)
Cash recovery rate of total assets		808.4806**
		(2.3422)
Change rate of cost		-56.6321
		(-1.4296)

Note. the values in brackets in the table are t coefficients of regression analysis; *, * **** The significant levels are 10%, 5% and 1%, respectively

From the regression analysis results of test 1 in Table 8, it can be seen that "the change rate of international oil price" and "the change rate of domestic oil price" are positively correlated with the internal control index, but not significant, indicating that the change of international and domestic oil prices has a certain positive effect on the strengthening of internal control measures of Listed Companies in China's oil exploitation industry, but does not have a significant effect. From the regression analysis of test 2 in Table 8, it can be seen that the correlation coefficient between the internal control index and the profitability index of Listed Companies in the oil exploitation industry is -2.6993, which is greater than -2.9117 in the regression analysis of model 1 (Table 7), indicating that the independent regression effect of the internal control index is stronger than that of the internal control index with the change of oil price. It can be seen that the "internal control index" is not an intermediary variable, that is, it is not the international and domestic oil prices that promote the oil and gas exploitation. Wang listed companies strengthen internal control and promote the improvement of enterprise profitability.

7. Conclusions and Policy Implications

7.1 Conclusion

(1) From 2011 to 2020, both international and domestic oil prices showed a downward trend. (a) The average international crude oil price showed a negative growth trend, from a positive growth of 19.38% in 2011 to a negative growth of 30.67% in 2020. The average annual decline rate of international oil price calculated according to the annual average oil price change rate was 6.71%. This provides convenience for China's oil refining and oil consuming units to import oil at a low price, but at the same time, it has impacted the sales market of China's oil exploitation products and significantly weakened the profitability of Listed Companies in China's oil exploitation industry. (b) Domestic oil prices also showed a negative growth trend. Taking 93# and 95% gasoline as examples, the average price of 93# gasoline in China's energy market in 2011 was 8403 yuan / ton, and the average price of 95# gasoline in China's energy market in 2020 was 6100 yuan / ton. The average annual decline of single oil price was 3.50%. If calculated according to the change rate of domestic average oil price, the average annual decline was 2.61%. There are many reasons why the decline rate of China's domestic oil price is not as fast as that of the international oil price from 2011 to 2020. The most important reason is that China has set the "floor price" (i.e. the minimum price) for crude oil since January 2016 and established the "oil price regulation risk reserve" system (Zhu Xueyi, 2019). Therefore, although China's oil price decreased from 2011 to 2020, it did not affect the profitability of Listed Companies in China's oil exploitation industry.

(2) From 2011 to 2020, the internal control index of Listed Companies in China's oil exploitation industry continued to decrease. In 2011, the aggregate average internal control index of Listed Companies in China's oil exploitation industry was 701.3, decreased to 556.1 in 2020, with an average annual decrease of 2.64%. It is precisely because of this decline that empirical research shows that the

internal control index of Listed Companies in China's oil exploitation industry is significantly negatively correlated with their profitability, that is, from 2011 to 2020, listed companies in China's oil exploitation industry did not improve their profitability by strengthening internal control and changing internal mechanism. The intermediary variable test shows that the changes of international and domestic oil prices do not significantly promote the listed companies in China's oil exploitation industry to strengthen internal control.

(3) From 2011 to 2020, listed companies in China's oil exploitation industry adhered to the concept of sustainable development, paid attention to scientific and technological investment, effectively operated assets and increased cash flow. These measures have significantly improved the profitability of Listed Companies in China's oil exploitation industry.

(4) From 2011 to 2020, listed companies in China's oil exploitation industry paid attention to cost control and debt scale control. The former significantly improved the profitability of Listed Companies in China's oil exploitation industry, while the latter played a certain role in improving the profitability of Listed Companies in China's oil exploitation industry, but it was not significant.

(5) From 2011 to 2020, listed companies in China's oil exploitation industry paid attention to accelerating the turnover of fixed assets, which played a certain role in promoting the improvement of enterprise profitability, but it was not significant.

7.2 Policy Implications

In today's society, oil is the most important energy for economic and social development all over the world. Listed companies in China's oil exploitation industry should develop themselves at the height of world strategic development: first, deal with the relationship between changes in international oil prices and changes in domestic oil prices and prevent the risk of energy crisis (Zhu Liangfeng & Zhu Xueyi, 2019): not only do a good job in linking and floating domestic oil prices with international oil prices, but also see the political, social and volatile nature behind changes in international oil prices, Improve the "self-sufficiency rate" of China's domestic oil products and reduce China's excessive dependence on foreign oil and its risks. Second, strengthen internal management and improve the level of internal control. The evaluation of the enterprise's internal control level by an external third party should be taken as a hard index to evaluate the business performance of the management decision-making level of listed companies, so that they can actively and consciously implement the internal control measures to each internal management department, so as to serve the transformation of internal management mechanism (Zhu Liangfeng & Zhu Xueyi, 2021) and the improvement of profitability.; Third, we should guard against capital liquidity risk (Zhu Xueyi & Zhu Liangfeng, 2017). Empirical research shows that there is a significant negative correlation between the current ratio of Listed Companies in China's oil exploitation industry and their profitability from 2011 to 2020. The main reason is that the current liabilities of Listed Companies in China's oil exploitation industry have increased too fast. This will bring two major risks: one is the risk of insufficient short-term solvency of Listed Companies in China's oil exploitation industry; Second, the risk of insufficient working capital for normal turnover.

We should accelerate the turnover of working capital by controlling the scale of current liabilities such as short-term loans, accelerating the recovery of enterprise accounts receivable and improving profitability, so as to effectively prevent capital liquidity risks.

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Conflicts of Interest

The author declares no conflict of interest.

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